

Spotlight

A typical Costa Rican specimen of the Blue-jeans frog *Oophaga pumilio*.



COLORFUL AND POISONOUS DENDROBATIDS
RAINFOREST JEWELS

Technicolored, tiny and often dangerous, the gem-like frogs lurking on the Central and South American rainforest floor come in a dazzling variety of liveries

TEXT AND PHOTOS
BY CESAR BARRIO AMOROS



A yellow-green morph of  *Oophaga granulifera* from southern Costa Rica.

It is well known that some of the most appealing anurans in the world are the colorful and poisonous frogs belonging to the family *Dendrobatidae* (badly called poison arrow or dart frogs, as just two of them, *Phyllobates terribilis* and *P. bicolor* from Chococoan Colombia have been used by Amerindians to poison their darts). Several spots on the Neotropics stand out by the diversity of such rainforest jewels, such as the Upper Amazon and lower Central America. As I live in southern Costa Rica, very close to the Panamanian border, I have often had the opportunity to explore many times the Pacific and Caribbean rainforests of these two countries where these flamboyant frogs live. This is the realm of the *Oophaga* species and morphs. *Oophaga pumilio* is probably the most polymorphic species known among frogs. It occurs from mid-Nicaragua to northwestern Panama, but the real variation occurs in Bocas del Toro. *Oophaga granulifera* is a much less known species, similar in size and habits to *pumilio*, with a granular dorsal skin, and a few reported color morphs. Two more species are known in the western mountains of Panama, *Oophaga speciosa* and *O. arborea*, but these species are rare, and the first at least has not been seen for many years in the wild. A last species, *O. vicentei*, occurs in northern Panama, further east, and is

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Two *Oophaga pumilio* from Matina, province of Limón, Costa Rica.

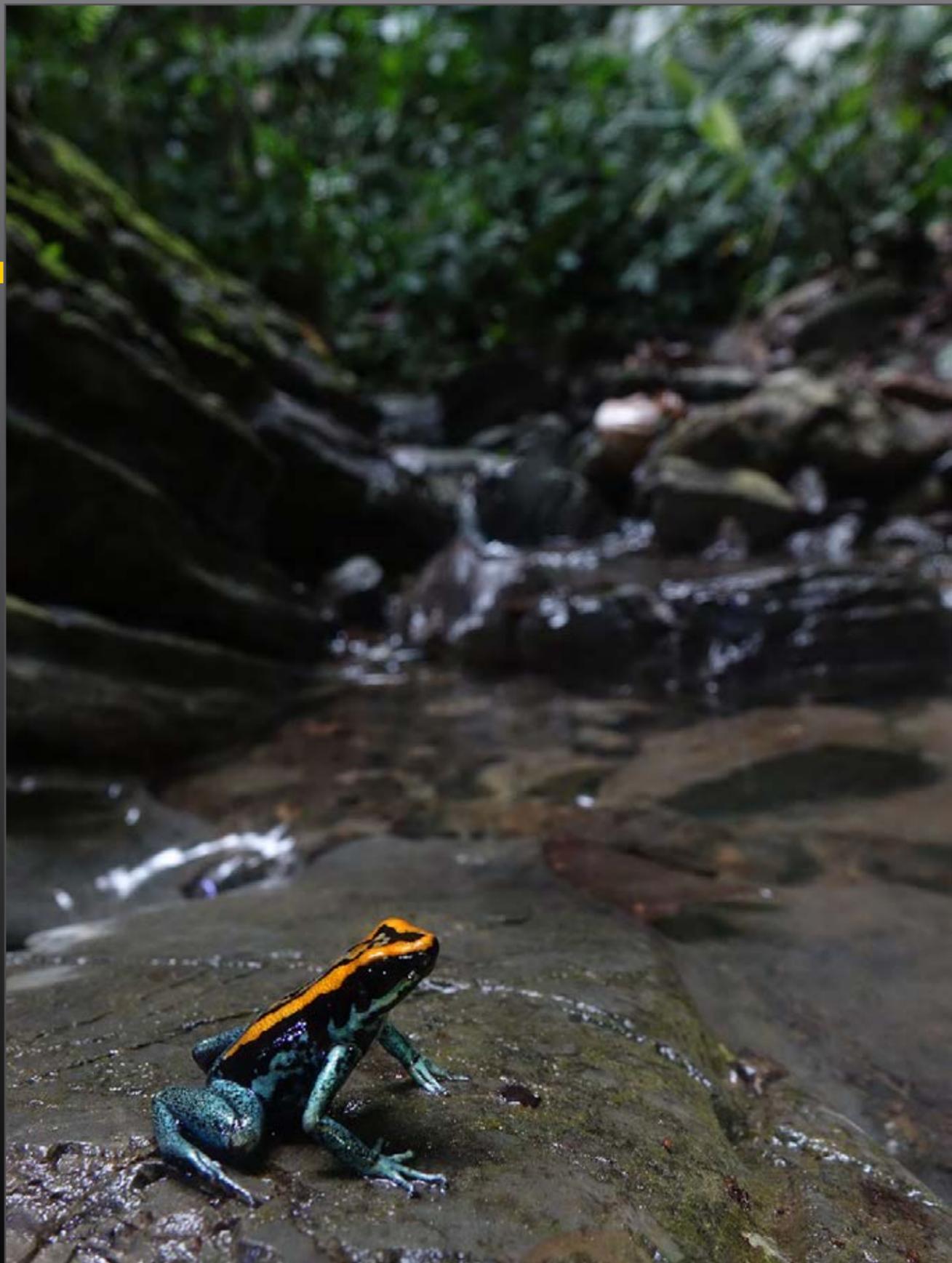


■ Top left, *Oophaga granulifera*, yellow morph; top right, *Dendrobates auratus* from Mareas; bottom left, *Phyllobates lugubris*; bottom right, another variation of *Oophaga pumilio*, this time from Isla Colón, Panama.

■ *Oophaga pumilio*
from Rio Gloria.



Right,  *Phyllobates vittatus*, an endemic species from South-western Costa Rica; far right, another *Oophaga pumilio* from Rio Gloria, Panama.



highly arboreal. Furthermore, two species of *Phyllobates*, *P. lugubris* at the Caribbean side of Nicaragua, Costa Rica and Panama, and *P. vittatus* only on the Costa Rica Pacific side could be the most toxic species of poisonous frogs in the region. One of the smallest dendrobatids also occurs in the area, *Andinobates claudiae*, and although it can be quite abundant in many localities both in the islands and mainland, it is a highly secretive species. The last and largest species to consider is *Dendrobates auratus*, with several morphs, especially in Panama. Let's take a closer look on each species.

Oophaga granulifera: Endemic from southwestern Costa Rica. It is a

terrestrial species living in the leaf litter of the rainforest floor. It is easier to see and hear during the rainy season when males call usually on top of exposed perches in the forest. The red and red and blue morphs are easy to spot among the leaf litter, while the yellow and green morphs are much more cryptic, and could be less poisonous. They utilize *phytotelmata* aquatic microhabitats (especially *Dieffenbachia*) to lay single eggs which will be fed with an unfertile egg laid by females. At night they are found sleeping on small leaves along creeks.

Oophaga pumilio: From mid Nicaragua to the Caribbean slopes of Costa Rica, all morphs are

Right, another colorful morph of *Oophaga pumilio* from Isla Bastimentos, Panama; far right, a striking blue morph of *O. pumilio* from the Aguacate peninsula, Panama.



predominantly red; some with blue or black legs and arms, some with only hands and feet blue, some red with dark spots, and some burgundy red. In Panama, the situation changes and aside of red with blue or completely red morphs, in Bocas del Toro archipelago and immediate mainland a whole fan of crazy varieties start to show the most polymorphic frog species in the world. In Isla Colon the dominant color is greenish yellow with black spots and orange or green legs; in Solarte they are pure orange or reddish with or without scattered small black spots; in San Cristobal they are red to orange with very small black spots and blue legs; Bastimentos probably shows the widest variation on a single island, from red to orange to yellow or white background with more or less black spots, white flanks and legs. On mainland also there is a huge variation, from pure sea blue or with black spots to violet in Aguacate Peninsula to black and white in Robalo or yellow with long black spots or stripes with white and black legs, to similarly common blue jeans (red with blue legs) or completely red in the norther sector of mainland Bocas del Toro near the border with Costa Rica. Many questions arise about this uncommon and amazing variation. Why? Why a single species is so variable in colors? What advantages this adaptation gives? Are different morphs more

Right, two
 Oophaga
 granulifera
 among the
 dark, wet
 forest litter;
 far right,
 a dazzling
 specimen of
 Dendrobates
 auratus.



prone to acquire sexual partners or escape predators than others? Many investigators are still answering these and many other questions about the adaptation and evolution of this species. In different islands and localities in mainland I visited I can realize how different the various morphs are not only in color but also in behavior. While in mainland some red morphs are terrestrial, the painted (black and white and yellow and black: all highly aposematic) ones are arboreal. Same with red and orange morphs in the islands (Solarte, San Cristobal and Bastimentos), being more terrestrial than yellow or greenish in Colón for example; while blue and violet morphs are equally terrestrial and

arboreal. Also is notable a change in size, for example Red and blue pumilios (both in Costa Rica, Nicaragua and Panama) are much larger than spotted or bluish morphs. A paper by the team of Heike Pröhl back in 2007 treated the genetic diversity finding that three clades are present, one north or Rio Reventazón in Costa Rica to Nicaragua, with the available name of *Dendrobates (Oophaga) typographus*. Another clade from the Escudo de Veraguas island, which would correspond to a new species to describe, and the *pumilio sensu stricto* from southern Costa Rica and western Panama. Still much investigation must be done to solve the multiple mysteries of this outstanding species.

Oophaga vientei: This is a hard species to find, due to its highly arboreal habits. They inhabit large bromeliads from 3 to 20 m above the floor, and call frenetically all day long. Only in a few places *vicentei* can reach the soil or on large bromeliads. At Santa Fe, Panama, two morphs occur, one red, and other green. We failed to see the red one, on the top of a hill, but despite hearing many calls in the lowlands around, we only could see one green female at a large bromeliad 3 m above the forest floor.

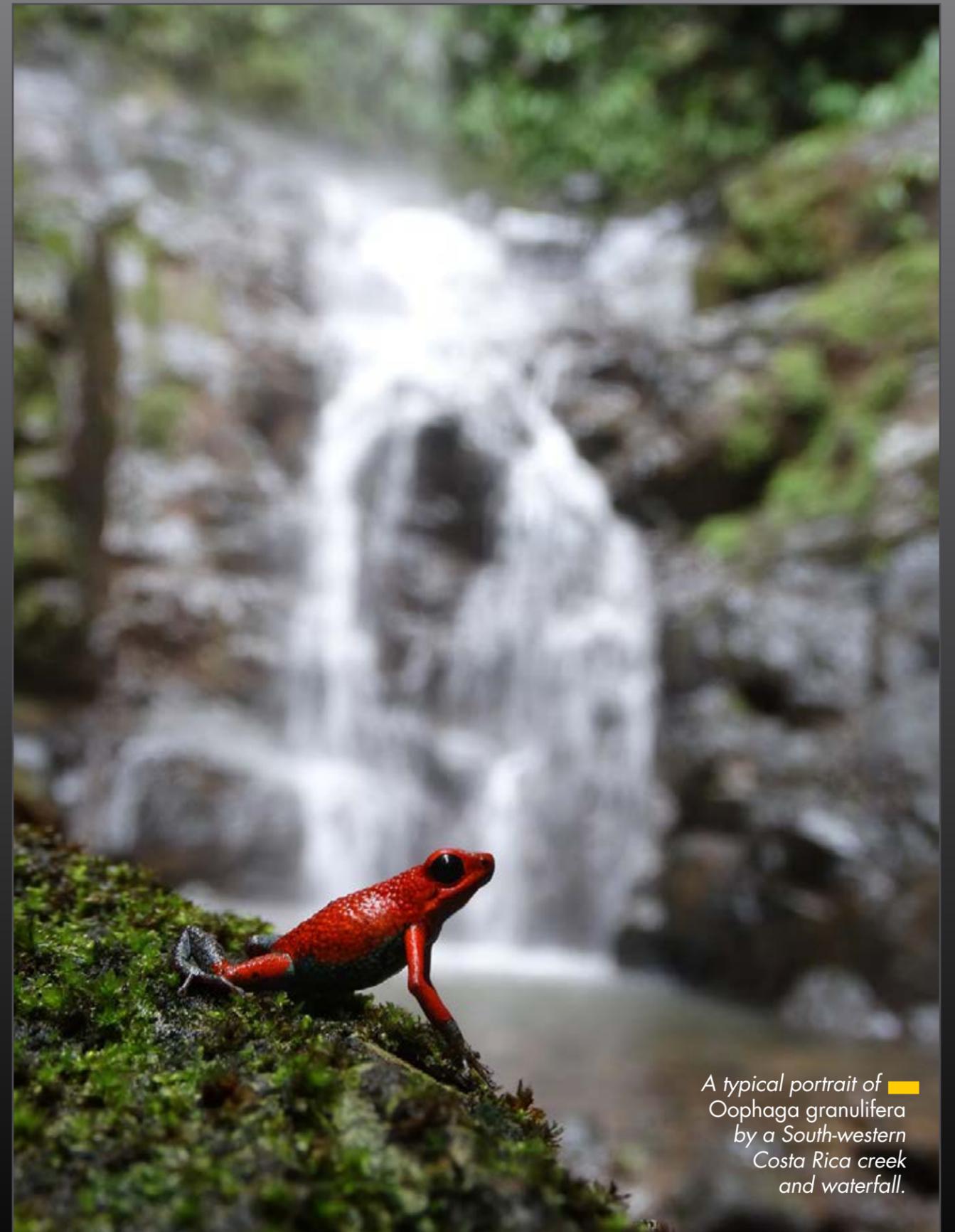
Dendrobates auratus: This is the largest *Dendrobatidae* of Central America, attaining up to 4 cm. It is also quite variable, especially in Panama. Unfortunately I couldn't see yet the most astonishing color morphs. Where I live, in Pacific Costa Rica, they are predominantly black with green; in the Costa Rican Caribbean side and close Panama (including Bocas del Toro) are green with black; but further east some incredible morphs start to show, like black with white or intense blue with black, or entirely black with small green spots. I only managed to see one population of chocolate color with dirty white, interesting enough though.

Andinobates claudiae: On the contrary, this is the smallest species of dendrobatid (with *A. minutus*) of Central America, both barely surpassing one cm in length. It was a little difficult to figure out where it was to be found. André Schreiber

and I were searching for *Phyllobates lugubris* and *pumilio* along a creek in a forest in Isla Colón, when he saw something he believed to be a juvenile *P. lugubris*. Then we heard a weird call, and immediately knew that it was *claudiae*. Very fast, and escaping by hopping much longer than expected, at last we could take a few pictures and then released it.

Phyllobates lugubris: This species is the smallest of two in Central America. It is quite abundant in proper habitats both in Costa Rica and Panama (I don't have experience yet in Nicaragua), but can be extremely rare at others. They are basically black with two narrow yellow dorsolateral stripes, some white spots on flanks and ventrally and pinkish with black marbled on legs. Contrary to other aposematic dendrobatids, *Phyllobates* likes to call while well hidden in holes or under debris. They like dark and narrow ravines, where they can hide in crab holes. At night I have found them sleeping on medium sized rocks in small creeks.

Phyllobates vittatus: This larger species has also brighter colors, black with orange to red wider dorsolateral stripes, white and black reticulation on flanks and venter and bluish with black marbled on legs. It also inhabits narrow or dark creeks inside holes, and hides immediately if they see any danger. This species has proven to be the most poisonous species in Central America, but not as much as their Colombian



A typical portrait of ■ *Oophaga granulifera* by a South-western Costa Rica creek and waterfall.

Right, a typical specimen of *Oophaga granulifera*; far right, the less flamboyantly patterned *Phyllobates lugubris*. The relative size of the small forest floor cup mushroom gives a good idea of how tiny *Dendrobatids* really are.



counterparts. It is endemic from southwestern Costa Rica.

A final note on my research: I have been accompanied in the field by many colleagues and friends, some of which I guided, some of which have guided me. I am highly grateful to all who share this passion with me: Angel Sosa, Claudia Koch, Eileen Marie Rivera, Gerardo Boa, the Tropical Herping team and André Schreiber. In writing this article I simply want to share with all the amazing variation of colors and morphs of these beautiful frogs. In no case I am encouraging collection, and thus, I don't give detailed localities for any species or morph.

About travelling in Costa Rica and Panama: These two small Central American countries are easy to visit and quite secure. Just taking normal care of your belongings and not leaving anything without proper attention is enough to enjoy your tour. In both countries US dollars are widely accepted. In Costa Rica there are plenty of good guides that can help organizing a trip and getting to the most incredible places (looking for frogs or whatever you want).

I arrange herping tours in Costa Rica and western Panama, as well as other South American countries. Interested parties can contact me writing to cesarlba@yahoo.com